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P. Jones

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Title: SHIELD TYPE CONNECTOR

VERIFICATION OF TRANSLATION

Sir:

I, Hidemi Matsukura, being a member of SERA, TOYAMA, MATSUKURA & KAWAGUCHI, of 6th Floor, Yokoyama Building, 4-10, Higashi Nihonbashi 3-chome, Chuo-ku, Tokyo 103-0004 JAPAN, hereby declare that I am well conversant in both the Japanese and English languages, and that the attached document is a true translation of the above-identified Japanese Patent Application, made by me into the English language, to the best of my knowledge and belief.

Date: on this SEP. 4. 2000

Hidemi Matsukura, Patent Attorney

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CHUO-KU TOKYO JAPAN

NOTARIAL CERTIFICATE
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Subscribed before me,
on this SEP. 4. 2000

Masakazu Watanabe

Masakazu Watanabe
Notary, attached to
The Tokyo Legal Affairs Bureau
No. 1-10, Nihombashi, Kabuto-cho,
Chuo-ku, Tokyo, Japan.

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(Convention de La Haye du 5 octobre 1961)

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10. **Signature:**

T. Mochizuki

Takeshi MOCHIZUKI

For the Minister for Foreign Affairs

MOLEX INCORPORATED Information Sheet

JPSR No.	Engineering Group
J99097-4	Japan Consumer
Our Ref.	
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Joint Applicant	

The name of Inventors (Creators)	The Company of the inventors
(1) Tomisaburo YAMAGUCHI	
(2) Tetsuya ASAKAWA	

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[TITLE OF THE INVENTION] SHIELD TYPE CONNECTOR

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[INVENTOR]

[Address or Residence]

c/o Japan Molex Inc.

1-5-4 Fukamihigashi, Yamato-shi,

Kanagawa-ken

[Name] Tomisaburo YAMAGUCHI

[INVENTOR]

[Address or Residence]

c/o Japan Molex Inc.

1-5-4 Fukamihigashi, Yamato-shi,

Kanagawa-ken

[Name] Tetsuya ASAKAWA

[INVENTOR]

[Address or Residence]

c/o Japan Molex Inc.

1-5-4 Fukamihigashi, Yamato-shi,

Kanagawa-ken

[Name] Shigenori YAMAGUCHI

[APPLICANT FOR PATENT]

[Identification Number] 591043064

[Name or Appellation] Molex Incorporated

[ATTORNEYS]

[Identification Number] 100089244

[Patent Attorney]

[Name or Appellation] Tsutomu TOYAMA

[Identification Number] 100090516

[Patent Attorney]

[Name or Appellation] Hidemi MATSUKURA

[Telephone Number] 03-3669-6571

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[LIST OF DOCUMENTS SUBMITTED]

[Name of Document] Specification 1

[Name of Document] Drawing 1

[Name of Document] Abstract 1

[Need of Proof] YES

[NAME OF DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] SHIELD TYPE CONNECTOR

[SCOPE OF CLAIMS FOR A PATENT]

[CLAIM 1] A shield type connector provided with an insulating housing for holding a contact and a shield member overlapping over a surface of the insulating housing, said shield member including a metal shell having a frame portion for surrounding a circumference of an opening for connection with which a terminal portion of an associated connector is engaged and a metal shield disposed between the metal shell and the insulating housing, wherein said metal shield has spring pieces for holding an engagement condition of the terminal portion in contact with the surface of the terminal portion upon the engagement with the terminal portion of the associated connector.

[CLAIM 2] The shield type connector as set forth in claim 1, wherein said spring pieces are provided on right and left inner wall surface sides of the opening for connection into which said terminal portion is inserted, respectively, and set to be brought into contact with right and left side surfaces of the terminal portion which the respective spring pieces face.

[CLAIM 3] The shield type connector as set forth in claim

1 or 2, wherein said metal shield has a top surface shield portion for covering a top surface of the insulating housing and side surface shield portions for covering both side surfaces of the insulating housing, said spring pieces are formed on these side surface shield portions, respectively, each spring piece has a proximal end portion continuous with the side surface shield portion and a free end portion extending from the proximal end portion, and the free end portion extends to a back surface side of the insulating housing along the side surface shield portion.

[CLAIM 4] The shield type connector as set forth in any of claims 1 to 3, wherein said metal shield has an engagement piece that engages with a recess portion of the surface of the terminal portion upon the engagement with the terminal portion of the associated connector.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[TECHNICAL FIELD TO WHICH THE INVENTION PERTAINS]

The present invention relates to a shield type connector provided with a metal shell for shielding for preventing an electric noise on an outer circumferential surface of an insulating housing for holding a contact.

[0002]

[PRIOR ART]

It is known that a metal shield member is disposed on an outer circumferential surface of a substantially box-shaped insulating housing of an electric connector for the purpose of preventing an electric noise. Examples of this type of shield type electric connector are disclosed in Japanese Utility Model Application Laid-Open No. Hei 5-34679 and Japanese Patent Application Laid-Open No. Hei 10-83866. The disclosed electric connector is a substrate actually mounted type connector and is disposed so that a pair of substantially U-shaped shield members made of metal plates are overlapped on four surfaces or three surfaces of the outer circumference of a substantially box-shaped insulating housing.

[0003]

Figs. 15 and 16 show an example of such a conventional shield type electric connector. Incidentally, a receptacle connector R is shown in Fig. 15, and plug connector P is shown in Fig. 16. However, since the receptacle connector R is smaller in size than the plug connector P, Fig. 15 is shown on a large scale.

[0004]

In case of the receptacle connector R shown in this Fig. 15, the shield member is composed of a metal shell 320 disposed on the outermost position and shaped substantially in a U-shape in plan view and a shield metal plate 330 having a U-shape in cross section and disposed between the metal shell 320 and the inner insulating housing. The metal shell 320 is disposed so as to cover the three surfaces, i.e., the front surface and both side surfaces of the insulating housing and the shield metal plate 330 is disposed so as to cover the three surfaces, i.e., the top surface and both side surfaces of the insulating housing. Thus, the four surfaces, i.e, the front surface, the top surface and both side surfaces of the insulating housing are shielded. An engagement piece 303 that is engaged with an engagement recess portion 311 of a terminal portion 310 that serves as a shield metal for the plug connector (associated connector) P is provided on the shield metal plate 320.

[0005]

The metal shell 320 has a front surface shield portion 323 and side surface shield portions 324, 324 on both sides. An engagement sleeve portion 307 forming an opening 321 into which

the terminal portion 310 of the plug connector P is inserted is provided in the front surface shield portion 323. As shown, the engagement sleeve portion 307 is formed substantially into a rectangular sleeve shape to project on the front side. This metal shell 320 is formed by a drawing work of a portion of the engagement sleeve portion 307 after a punching-out work of the metal plate. Numeral 308 denotes a convex portion for giving an engagement polarity and numeral 312 denotes a recess portion that engages with the convex portion 308. Numeral 313 denotes a pin contact.

[0006]

[PROBLEMS TO BE SOLVED BY THE INVENTION]

The recent electric connectors tend to be miniaturized. Also in the above-described substrate actually mounted type connector is demanded to be miniaturized. In contrast, it is demanded to reduce a manufacturing cost and also to enhance the dimensional stability. Also, it is important to aim the enhancement of the shield property and its stability while keeping the miniaturization.

[0007]

However, in the above-described connector, in particular,

since the engagement sleeve portion 307 is formed by the drawing work, there is a problem that the manufacturing cost is high and the outer contour is enlarged, resulting in difficulty in miniaturization. Also, since the engagement sleeve portion 307 is formed by the drawing work, there is also a problem that the dimensional stability of the engagement sleeve portion 307 is not satisfactory. Furthermore, a large force caused by "twist" or the like upon the engagement with the plug connector P is applied to the portion of the engagement sleeve portion 307 that has thus been drawn, it is not absolutely said that a so-called restoration, i.e., the phenomenon that the drawing is returned depending upon the drawing force, would not occur. This point should be considered sufficiently in the connector in which the insertion/removal operations are frequently repeated.

[0008]

In the connector in which the insertion/removal operations are frequently repeated, due to the frictional wear or deformation of the engagement portions, there is a fear that the contact stability (contact strength) between the shield members of the plug connector and the receptacle connector is gradually reduced to form a displacement. For this reason,

depending upon the frequency and condition of the insertion/removal operations, there is a fear that the grounding stability that the noise components are led to the earth on the substrate side would be degraded or the stability of the insertion/removal operations would be degraded.

In particular, with respect to the grounding stability, due to the displacement, there is a fear that the electric connection between the plug side and the receptacle side is unstable and it is difficult to lead the transmitted noise components to the earth on the substrate side.

[0009]

On the other hand, with respect to the shield effect, it is possible to form the shield member by durable die-casting instead of the molding/bonding member made of thin plates. However, in this case, since the ductility is poor in comparison with the formation of thin plates, a high precision is strictly required over the entire portions related to the engagement. In particular, a positional relationship between the shield member and the contact holding portion in its interior is determined in manufacturing. For this reason, upon the engagement with the associated connector, an excessive stress is given to the contact

portions between the two or the like. There is a fear that a deformation occurs in each part of the two while the frequent insertion/removal operations are repeated for a long period of time.

[0010]

The present invention has been made in view of the above points, and therefore has an object of the present invention to provide, particularly on a receptacle side of a shield type connector, a shield type connector which is durable against use for a long period of time and is very effective in enhancing connection reliability with the plug side and stability of insertion/removal operation and in removing noise components upon the connection with the plug side.

[0011]

[MEANS FOR SOLVING THE PROBLEM]

The present invention has employed the following means in order to solve the above described problems.

A first means of the present invention is characterized by a shield type connector provided with an insulating housing for holding a contact and a shield member overlapping over a surface of the insulating housing, the shield member including

a metal shell having a frame portion for surrounding a circumference of an opening for connection with which a terminal portion of an associated connector is engaged and a metal shield disposed between the metal shell and the insulating housing, characterized in that the metal shield has spring pieces for holding an engagement condition of the terminal portion in contact with the surface of the terminal portion upon the engagement with the terminal portion of the associated connector.

[0012]

According to this means, the metal shield has spring pieces for holding an engagement condition of the terminal portion in contact with the surface of the terminal portion upon the engagement with the terminal portion of the associated connector so that the terminal portion may be held in a stable condition without any displacement. Thus, the electric connection is stable between the receptacle side and the plug side which is the associated connector. The transmitted noise components may be led stably to the earth on the substrate side. Also, the spring pieces are brought into contact with the surface of the terminal portion so that the resistance and positioning effect take place by the friction between the surface of the terminal

portion and the spring pieces upon the insertion/removal operation of the plug connector. The resistance and positioning effect is allowed to be stable through spring pieces, thereby being enhanced in the stability of the insertion/removal operation.

[0013]

A second means of the present invention is characterized in that, in the first means of the present invention, the spring pieces are provided on right and left inner wall surface sides of the opening for connection into which the terminal portion is inserted, respectively, and set to be brought into contact with right and left side surfaces of the terminal portion which the respective spring pieces face.

[0014]

According to this second means, the spring pieces disposed on right and left are set to be brought into contact with right and left side surfaces of the terminal portion which the respective spring pieces face so that the terminal portion may be clamped and held from both sides. Thus, the stability (ground stability) of the electric connection between the plug side and the receptacle side and the stability of the

insertion/removal operation are further enhanced.

[0015]

A third means of the present invention is characterized in that, in the first and second means of the present invention, the metal shield has a top surface shield portion for covering a top surface of the insulating housing and side surface shield portions for covering both side surfaces of the insulating housing, the spring pieces are formed on these side surface shield portions respectively, each spring piece has a proximal end portion continuous with the side surface shield portion and a free end portion extending from the proximal end portion, and the free end portion extends to a back surface side of the insulating housing along the side surface shield portion.

[0016]

According to this third means, each spring piece is in the form of a plate and its free end portion extends to the rear surface side of the insulating housing along the side surface shield portion. Namely, the free end portion of each spring piece extends in the insertion direction of the terminal portion. For this reason, it is possible to bring each spring piece into contact with the surface of the terminal portion by simply

bending a part of each spring piece in a direction to close to each other. In this case, since each spring piece is in the form of a plate, it is also possible to bring the spring piece into uniformly area-contact with the surface of the terminal portion. Since the free end portion of each spring piece extends along the insertion/removal direction of the terminal portion, there is no fear that the presence of the free end portion would interfere with the insertion/removal operation of the terminal portion.

[0017]

A fourth means of the present invention is characterized in that, in the first to third means of the present invention, the metal shield has an engagement piece that engages with a recess portion of the surface of the terminal portion upon the engagement with the terminal portion of the associated connector.

[0018]

According to this fourth means, it is possible to prevent the plug connector from being pulled apart accidentally by the engagement effect of the engagement piece. In addition, since the contact effect of the spring pieces is applied in addition to the engagement effect of this engagement piece, the stability of the electric connection (ground stability) between the plug side and

the receptacle side and the stability of the insertion/removal operation may be further enhanced.

[0019]

[EMBODIMENT MODE OF THE INVENTION]

An embodiment mode of the present invention will now be described with reference to the accompanying Figs. 1 to 14.

The embodiment mode of the present invention shown in these drawings is applied to a so-called dip type electric connector which is actually inserted and mounted on a circuit substrate.

[0020]

As shown in the perspective view of Fig. 1, the frontal elevational view of Fig. 2, the cross-sectional view of Fig. 3 and the like, this shield type connector R is provided with an insulating housing for holding a contact 1 and a metal shell 20 for shielding overlapping over the surface of the insulating housing 10. An opening for connection 21 for engagement with a terminal portion of an associated connector (see Fig. 16) and a frame portion 22 for surrounding the circumference of the opening for connection 21 are provided to the metal shell 20.

[0021]

The frame portion 22 is formed into a portion of the seamless continuous metal plate surrounding one turn around the circumference of the opening for connection 21. A convex portion 22a projecting from the part of the frame portion 22 is formed on a central lower portion of the opening for connection 21. The convex portion 22a is a convex portion for giving an engagement polarity with the associated connector. Incidentally, since it is possible to use the conventional plug connector that is the same as that shown in Fig. 16 as the associated connector, it is not particularly shown here.

[0022]

As shown in Fig. 3, the insulating housing 10 is formed substantially into a box shape and made of resin and is provided in its interior with a contact holding portion 11 and an insertion opening 12 into which the pin contact of the associated connector is to be inserted. The tip end portion 2 of the contact 1 is held by the tip end holding portion 13 of the insulating housing 10. A curved portion 3 curved so as to enter the insertion opening 12 is formed in the vicinity of the tip end portion 2 of the contact 1 so that the contact strength with the pin contact which is to be inserted into the insertion opening

12 is enhanced.

[0023]

A tine 4 of the contact 1 is drawn from the rear surface side of the insulating housing 10, bent downwardly to extend straight and projected downwardly of the lower surface of the insulating housing 10. A portion of this tine 4 is inserted into a through hole or the like on the substrate to be soldered. The connector R shown in the example is a four pin connector. Accordingly, four contacts 1 are provided. In order to avoid the concentration of the tines 4 of the respective contacts 1, the respective tines 4 are arranged in a staggered manner.

[0024]

The metal shell 20 is formed by the bending work after the formation of the metal shell 20A in the developed shape by punching out a conductive metal plate as shown in Fig. 10. The metal shell has a front surface shield portion 23 indicated by (1), side surface shield portions 24, 24, on both sides, indicated by (2), a top surface shield portion 25 indicated by (3), a bottom surface shield portion 26 indicated by (4), engagement pieces 27, 27 indicated by (5), and fixture pieces 28, 28 indicated by (6). These portions constitute the overlapping

portion onto the surface of the insulating housing 10. The overlapping portions indicated by(1) to (6) are worked by bending along the positions indicated by dotted lines in the drawing. Thus, the metal shell 20 has a structure with the overlapping portions where at least one portion is overlapped on each of the six surfaces of the insulating housing 10.

[0025]

Thus, the metal shell 20 has the overlapping portions where at least one portion is overlapped on each of the six surfaces of the insulating housing 10 and only the bending work is effected to the overlapping portions so that the metal shell 20 may be fixed readily and firmly to the insulating housing 10.

[0026]

Also, joint portions (see Fig. 1) formed by the bending work of the developed shape 20A of the metal shell 20 along the dotted portions have the engagement pieces 27, 27 located on surfaces sides on both sides of the insulating housing 10 and engaged so that respective joint portions are flush with each other. As a result, the joint portions are not projected to the outside. Accordingly, corresponding to this, it is possible to make compact the outer appearance. In addition, the cutaways 29,

29 that engage with the engagement pieces 27 in order not to open the joint portions are arranged so as to intimately engage with the engagement pieces 27 within a range of a thickness of the plates of both components.

[0027]

Fig. 1 is a perspective view after the bending work of the metal shell 20, showing a completed connector R in which the internal insulating housing 10 is covered. A metal shield 30 formed by the punching-out work of a metal plate (punching-out and bending work) is further provided on this connector R. This metal shield 30 is disposed between the insulating housing 10 and the metal shell 20 and restricted by the metal shell 20.

[0028]

A frontal elevational view of the metal shield is shown in Fig. 11, a cross-sectional view thereof is shown in Fig. 12, a plan view thereof is shown in Fig. 13 and a right side elevational view thereof is shown in Fig. 14, respectively.

[0029]

This metal shield 30 is formed substantially into a U-shape as viewed from the front surface and has a top surface shield portion 31 covering a part of the top surface of the

insulating housing 10, side surface shield portions 33, 33 covering both side surfaces of the insulating housing 10, spring pieces 34, 34 formed on these side surface shield portions, and engagement piece 32 engaging with a terminal portion of the associated connector.

[0030]

Each spring piece 34, 34 is set to have a function for holding the engagement condition of the terminal portion in contact with the surface of the terminal portion upon the engagement of the terminal portion of the associated connector with the receptacle connector R and holds the terminal portion without any displacement. Namely, each spring piece 34, 34 is in the form of a plate having proximal portions 34a, 34a continuous with the side surface shield portions 33, 33 and free end portions 34b, 34b extending from the proximal portions. The free end portions 34b, 34b extend on the side of the back surface of the insulating housing 10 along the side surface shield portions.

[0031]

Cutaways 35, 35 having a substantially U-shape as viewed from the side surface are formed on both side surface shield portions 33, 33 in order to form, on both side surface shield

portions 33, 33, the respective spring pieces 34, 34 each of which is in the form of a plate. Each spring piece 34, 34 is projected inwardly substantially in the range of the plate thickness by bending in the vicinity of the proximal end portion 34a, 34a. Thus, each spring piece 34, 34 is disposed on the inner wall surface side on each of the right and left sides of an opening for connection 21 into which the terminal portion is inserted. Each spring piece 34, 34 is arranged so as to bring into contact with the side surfaces on each of the right and left sides of the terminal portion, which the respective spring pieces face.

[0032]

The engagement piece 32 is bent rearwardly through a bent portion 32a so that its free end portion 32b is located within the insulating housing 10. Then, an engagement convex portion 32c that is to be engaged with the recess portion on the surface of the terminal portion is provided in the vicinity of its free end portion 32b. In the drawings, reference character 24a denotes a projection piece inserted into a slot formed in a circuit substrate or the like (not shown) to be soldered thereto.

[0033]

In the embodiment mode, the metal shield 30 has both spring pieces 34, 34 for holding the engagement condition of the terminal portion in contact with the surface of the terminal portion upon the engagement of a terminal portion (310) of a plug connector (P), so that the terminal portion (310) is held in a stable condition without any displacement. Thus, the electrical connection between the plug connector (P) that is the associated connector and the receptacle connector R is stabilized to thereby make it possible to lead the transmitted noise components to the earth of the substrate side in the stable manner. Also, the spring pieces 34, 34 are brought into contact with the surface of the terminal portion, whereby the resistance and positioning effect occur due to the friction between the surface of the terminal portion and the spring pieces 34, 34 upon insertion/removal operation of the plug connector. Since the resistance and positioning effect are stabilized by the presence of the spring pieces, the stability of the insertion/removal operation is also enhanced.

[0034]

Also, with an arrangement in which the spring pieces 34, 34 disposed on the right and left sides are brought into contact

with the right and left side surfaces of the terminal portion which the respective spring pieces face, it is possible to hold the terminal portion so as to clamp it on both sides. Thus, the stability of the electrical connection (grounding stability) between the plug side and the receptacle side and the stability of the insertion/removal operation are further enhanced.

[0035]

Also, each spring piece 34 is in the form of a plate with its free end portion 34b extending on the rear surface side of the insulating housing 10 along the side surface shield portion. For this reason, only by a simple machining work like bending parts of the respective spring pieces 34, 34 in a direction to close to each other as shown, it is possible to bring the parts into contact with the surfaces of the terminal portion. In this case, since each spring piece 34, 34 is in the form of a plate, it is possible to bring it into uniformly area-contact with the surface of the terminal portion. Also, since the free end portion 34b of each spring piece 34, 34 extends in the insertion/removal direction of the terminal portion, the presence of the free end portions 34b, 34b do not interfere with the insertion/removal operation of the terminal portion.

[0036]

Incidentally, according to the above-described embodiment mode, by the formation, through the punching-out work of a metal plate, of the metal shell in the developed form including the frame portion 22 and the opening for connection 21 with which the terminal portion of the associated connector engages, the stability of dimension of the opening for connection 21 is enhanced so that the opening for connection 21 with high precision may be provided. Also, since it is possible to use the punching-out work instead of the drawing work, the manufacture is facilitated, the cost may be reduced and the miniaturization may be attained. Furthermore, since the frame portion 22 surrounding the opening for connection 21 may be formed with the portion of the continuous metal plate without drawn portions or joint portions, it is superior also in mechanical strength.

[0037]

[EFFECT OF THE INVENTION]

As described above, according to the present invention, it is possible to provide, particularly on a receptacle side of a shield type connector, a shield type connector which is durable against use for a long period of time and is very effective in

enhancing connection reliability with the plug side and stability of insertion/removal operation and in removing noise components upon the connection with the plug side.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig.1]

Fig. 1 is a perspective view of a shield type connector in accordance with an embodiment mode of the present invention.

[Fig.2]

Fig. 2 is a frontal elevational view of the same shield type connector.

[Fig.3]

Fig. 3 is a cross-sectional view taken along the line III-III of Fig. 2.

[Fig.4]

Fig. 4 is a cross-sectional view taken along the line IV-IV of Fig. 2.

[Fig.5]

Fig. 5 is a side elevational view of the same shield type connector.

[Fig.6]

Fig. 6 is a plan view of the same shield type connector.

[Fig.7]

Fig. 7 is a bottom view of the same shield type connector.

[Fig.8]

Fig. 8 is a cross-sectional view taken along the line VIII-VIII of Fig. 6.

[Fig.9]

Fig. 9 is a cross-sectional view taken along the line IX-IX of Fig. 6.

[Fig.10]

Fig. 10 is a developed view of a metal shell in accordance with the embodiment mode of the present invention.

[Fig.11]

Fig. 11 is a frontal elevational view of a metal shield in accordance with the embodiment mode of the present invention.

[Fig.12]

Fig. 12 is a cross-sectional view of the metal shield in accordance with the embodiment mode of the present invention.

[Fig.13]

Fig. 13 is a plan view of the metal shield in accordance with the embodiment mode of the present invention.

[Fig.14]

Fig. 14 is a right side elevational view of the metal shield in accordance with the embodiment mode of the present invention.

[Fig.15]

Fig. 15 is a perspective view of a conventional shield type connector (receptacle connector).

[Fig.16]

Fig. 16 is a perspective view of a conventional shield type connector (plug connector).

[DESCRIPTION OF REFERENCE CHARACTERS]

R	plug connector
P	receptacle connector
1	contact
2	tip end portion
3	engagement convex portion
10	insulating housing
20	metal shell
21	opening for connection
22	frame portion
23	front surface shield portion

24	side surface shield portion
25	top surface shield portion
26	bottom surface shield portion
27	engagement piece
28	fixture piece
29	cutaway
30	shield member
31	top surface shield portion
32	engagement piece
33	side surface shield portion
34	spring piece
34a	proximal end portion
34b	free end portion
310	terminal portion serving as the shield metal
311	engagement recess portion
312	recess portion
313	pin contact

[NAME OF DOCUMENT] ABSTRACT

[SUMMARY]

[PROBLEM] To provide, particularly on a receptacle side of a shield type connector, a shield type connector which is durable against use for a long period of time and is very effective in enhancing connection reliability with the plug side and stability of insertion/removal operation and in removing noise components upon the connection with the plug side.

[SOLVING MEANS] An insulating housing 10 for holding a contact 1, and a shield member overlapping over a surface of the insulating housing 10 are provided. The shield member includes a metal shell 20 having a frame portion 22 for surrounding the circumference of an opening for connection 21 with which a terminal portion 310 of an associated connector is engaged and a metal shield 30 disposed between the metal shell 20 and the insulating housing 10. The metal shield 30 has spring pieces 34 for holding an engagement condition of the terminal portion in contact with the surface of the terminal portion upon the engagement with the terminal portion 310 of the plug connector P.

[SELECTED DRAWING] FIG. 1